Introduction – The role of GIS in law enforcement

For a police department to effectively safe guard a community it is essential that officers are provided with accurate, organized information in a timely manner. A GIS can provide a number of specialized tools to help dispatchers collect and relay this information to the officers on the scene.

An E-911 system is a perfect example of how law enforcement officials can benefit from GIS technology. A GIS can provide routing instructions to direct patrol cars to the scene using the most efficient route. An advanced system using real-time GPS locators could monitor an officers progress and provide alternate routes to avoid traffic congestion or blocked streets.

The ultimate goal of a law enforcement GIS is to reduce crime, not simply to increase response time. Using the information contained within the GIS, planners can establish a visible police presence in 'trouble' areas to reduce the number of incidents. By monitoring population growth and crime rates a GIS can also identify the need for additional equipment and/or manpower to ensure the safety of local citizens.

A) Crime Prevention

The key to preventing crime is community awareness and having the right people in the right place at the right time. A GIS can help identify when and where crimes are more likely to occur. An inspection of the area may reveal why that particular location is at risk. Increased lighting or opening an area by removing vegetation may help in certain instances, community bulletins or signs may also be helpful in warning citizens to be alert.

1) Spatial Data

a) Minimum Requirements

- Neighborhood watch areas
- Census data
- Incident locations
- Road network
- Building footprints
- Known 'trouble spots'

b) Optional Requirements

- Digital orthophotography
- E-911 data
- Public parks
- Street lights
- Traffic accident data
- Traffic volumes

2) Attribute Data

a) Minimum Requirements

- **Neighborhood Watch Areas**
  - ⇒ Locations and contacts for citizen awareness groups
- **Incident Locations**
  - ⇒ Incident date and time
  - ⇒ Description of incident
- **Road Network**
  - ⇒ Road Name
  - ⇒ Address Range
- **Building Footprints**

- ⇒ Address
- **Trouble Spots**
  - ⇒ Location
  - ⇒ Description

b) Optional Requirements

- **Neighborhood Watch Areas**
  - ⇒ Past activity
  - ⇒ Meeting locations and times
- **Incident Locations**
  - ⇒ Charges filed
  - ⇒ Witnesses
  - ⇒ Suspects
  - ⇒ Fatalities
- **Road Network**
  - ⇒ Address Range
  - ⇒ Limited Access (such as one way)
  - ⇒ Speed Limit
  - ⇒ Traffic Volumes
  - ⇒ Accident data
- **Building Footprints**
  - ⇒ E911 (Occupant info)
  - ⇒ Incident history
  - ⇒ General comments such as “Beware of the Dog”
  - ⇒ Driving Directions
- **Census Data**
  - ⇒ Population demographics
- **Trouble Spots**
  - ⇒ Incident history
  - ⇒ Recommendations
  - ⇒ General comments
- **Other**
  - ⇒ It is vitally imortant to include as much detail as possible about any information entered into the GIS. Any future applications developed for the system will rely on this data.

3) Data Acquisition Options

a) Planimetric Mapping

- On-screen (heads-up) digitization of map features from orthophotography
  - ⇒ Quick and inexpensive, but less accurate than using stereo plotters
- In-house Survey – GPS or traditional methods
  - ⇒ Accuracy and cost vary depending on equipment and personnel
- Contract with third party vendor for digitization work
  - ⇒ High degree of accuracy, increase in cost

b) Orthophotography sources

- VGIN’s VBMP imagery
- USGS orthophotography (DOQs)
- Aerial photography from a third party vendor

c) Incident database

- Manually verify and enter attributes for each incident report.

d) **Population Demographics**

- Acquire from US Census

4) Data Conflation Options

a) Conflation, in this context, refers to adjusting existing map features such as road ways, building foot prints, etc to match spatially corrected aerial photography, known as

ortophotography. It provides a way to check the accuracy of the digital data against what is actually on the ground.

5) GUI/Programming Options

a) Once data is complete, and a system is fully functional, custom queries and searches may be implemented to retrieve incidents that meet various criteria including type of crime, distance from a given point, perpetrator name, date/time window, etc.

b) The user interface is the key to the system but is often overlooked by programmers who are focused on the more difficult analytical functions. Before any program is developed, it is important for the programmer to discuss with the user what functions are needed and what tools will be most useful. In most cases the programmer is not the person who will be using the tools and may not realize the value of streamlining simple operations such as data entry.

6) Internet Functionality and Options

a) Data can be used for an online GIS application after the mapping has been linked to the incident reports.

b) The GIS can be used by law enforcement and community planners as well as by private citizens to increase crime awareness in local communities.

c) Due to the nature of police work, there are inevitably security concerns that need to be addressed. Not all of the information available to law enforcement officials should be made accessible to the public. It is possible to provide different levels of service based on login information, these levels need to be defined before the GIS is implemented.

7) Technical Requirements

a) Minimum Requirements

- 400-MHz
- 2-GB hard drive
- 256-MB RAM
- 15” monitor
- CAD/GIS software
- Internet connection (for downloading data, if applicable)

b) Optional Requirements

- A faster machine will make work quicker; listed above is absolute minimum
- 850-MHz or above recommended
- 20-GB hard drive for increased storage space
- 512-MB RAM for faster regeneration and manipulation of data
- 17” or 19” monitor for increased screen resolution (and larger viewing area)

8) Administrative/Management Requirements

a) Project manager to organize and maintain all work

b) At least one GIS technician to perform conversion and digitizing work; more technicians will decrease task time frame

9) Cost – Cost/Benefit

a) In-house

- GIS technician - $8-$14 per hour
- Project manager - $16-$20 per hour
- Note: in-house costs do not include benefits and overhead

b) Contracted

- GIS technician - $30-$50 per hour
- Project manager - $55-$70 per hour

c) Schedule:

- Assemble base mapping
  - ⇒ Digitize
  - ⇒ Annotate
  - ⇒ Conflate
- Enter incident reports

- ⇒ Plot incident location
- ⇒ Update database using reports from the scene

d) Benefits of a GIS

- A GIS provides a powerful, logical, and intuitive means to store, manipulate, and retrieve data.
- It can maintain, analyze, and report on geographic data such as points and symbols, lines and curves or polygons, and attribute data such as characters, numbers, and dates.
- A GIS provides the ability to see on screen or in map form, only those features or objects that meet specific selection criteria.
- In an instant, you can visually identify features in a geographic representation that would take much longer to find in a printed report.

10) Standards/Guidelines Summary

a) Must have a standard layer convention used throughout all digitized tax maps for accuracy and organization of data; for example:

- "*Building Footprints*" Layer
  - ⇒ Color: brown
  - ⇒ Weight: .05mm
- "*Incident Points*" Layer
  - ⇒ Color: green
  - ⇒ Weight: .05mm
- "*Annotation*" Layer
  - ⇒ Color: blue
  - ⇒ Text height: 30'

11) Startup Procedures/Steps

a) Digitization

- On-screen (heads-up) digitization
  - ⇒ Digitize, or acquire digitally, all building footprints.
  - ⇒ Digitize, or acquire digitally, all transportation features (roads, railroads, etc.).
  - ⇒ Digitize, or acquire digitally, local features relating to criminal activity (trouble spots, lighting, parks, etc.)

b) Annotation

- Label building footprints and incident points using a unique identifying number. This will be used to link the mapping to the database.
- Keep text insertion points inside of the referenced features, for ease in reading, database creation and linking after the data is ready.
- Minimum annotation needed:
  - ⇒ Unique building/crime scene identification numbers.
- Optional:
  - ⇒ Building address
  - ⇒ Crime type
  - ⇒ Comments

c) Conflation

- Verify that all digital orthophotography image chips to cover the county or interest area are accessible.
- Use CAD/GIS software to mosaic all image chips into one complete image, for ease of use.
- Conflate digital mapping as necessary to match orthophotography.

12) Estimated Time Line and/or Implementation Schedule

a) Basic tasks and estimated time, per tax map sheet, per task.

- Scanning (10 minutes) per sheet
- Digitization (3 hours) per sheet
- Annotation (1 hours) per sheet

- Conflation (4 hours) per sheet

b) Approximately 8 to 10 man-hours are needed to accomplish the above tasks for each tax map. This is based on a moderately populated area. Variations in population density can shorten or lengthen the time needed to complete all data for a single tax map.

13) Best Practice Examples in Virginia

a) The Crime Mapping Research Center (http://www.ojp.usdoj.gov/cmrc/) provides general information, links and tools for developing a law enforcement GIS.